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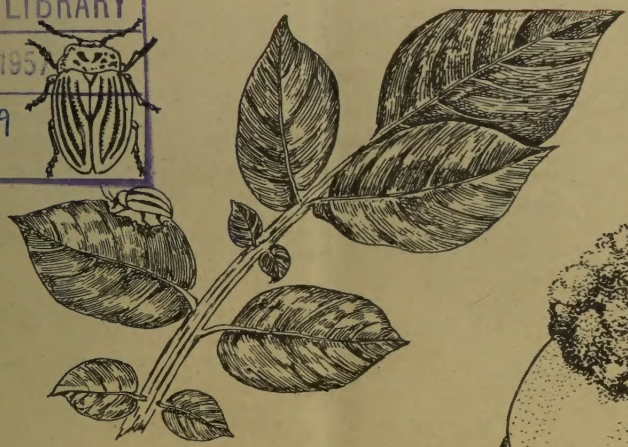
DIRECTORATE OF PLANT PROTECTION, QUARANTINE & STORAGE
MINISTRY OF FOOD AND AGRICULTURE, GOVERNMENT OF INDIA

PLANT PROTECTION BULLETIN

SCIENCE IN PRACTICE



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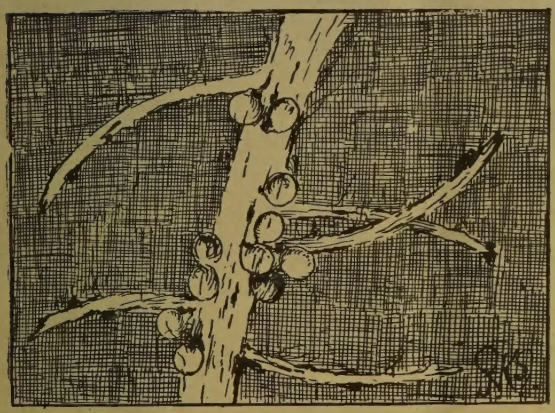

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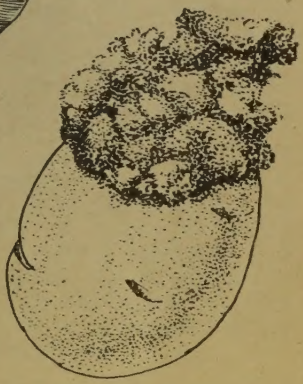

(3)

(1) Colorado Potato beetle.
(2) Potato root eelworm (Cysts).
(3) Wart disease on potato.

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NEW DELHI.

NOTE

Plant Protection Bulletin is intended to keep all Plant Protection workers in India informed of the progress of control work on plant pests and diseases in different parts of the country and of the advances and developments in Plant protection work in other parts of the world Suitable articles, reports, notes, observations and comments received from workers all over India will be published in the Bulletin. The notes from correspondents may also be in the form of suggestions, queries and opinions, even tentative, offered for discussion or consideration. The reports should in particular, contain information on the sudden outbreak of diseases or insect pests or the equally sudden disappearance of other diseases or pests from a particular area. The progress made in spraying, dusting and other methods of disinfestation should form a prominent part of the report. The intensity and severity of a disease or pest, and the prevalent conditions should be noted. If some varieties of a crop are not affected by a disease or pest, whereas others occurring in the vicinity have been attacked by them, then such information would be extremely useful. In reports containing control operations against pests and diseases, the cost of these operations and the savings obtained therefrom must be invariably stated. In accepting and publishing any material received from contributors, the Directorate of Plant Protection, Quarantine and Storage serves merely as an informational clearing house. It does not assume responsibility of the subject matter.

Any suggestions for the improvement of this Bulletin will be gratefully received.

K. B. LAL

Plant Protection Adviser to the Govt. of India.

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Linseed Rust Situation in India During 1953-54

By

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A survey of the main linseed growing tracts of India during 1953-54 showed that linseed rust, caused by *Melampsora lini*, appeared in the Punjab and in the sub-montane (*tarai*) region of Uttar Pradesh in the last week of January, 1954, and in the southern and eastern districts of U.P., towards the end of February. It appeared in Madhya Pradesh in the first week of February and in Bihar in the second week of the same month. No rust incidence was recorded at Aurangabad (Hyderabad), Jabalpur, Nagpur and Hoshangabad in Madhya Pradesh, Indore in Madhya Bharat, Bhopal and West Bengal. In Raipur and Balaghat districts of Madhya Pradesh, the variety EB 3 suffered from 30 to 60 per cent infection whereas the variety N 55 showed below 5 per cent infection. In Bihar, in the districts of Gaya, Hazaribagh and Patna, 40 to 70 per cent infection was observed on local varieties at the flowering stage. At Gurdaspur (Punjab), varieties BR 1 and BR 12 showed 40 to 60 per cent infection during the last week of January. An unidentified variety of linseed showed 40 to 60 percent infection at Ludhiana at the same time. Local varieties at Banaras and Allahabad showed 80 to 100 per cent infection whereas an improved variety Type 1 of Uttar Pradesh showed moderate infection at Jaunpur and Mirzapur districts of Uttar Pradesh.

Natural incidence on varieties Poona 12, 477-3/2, ICR 2, Atarra, N 55, RB 8, Banaras 2 and Mahoba was heavy at Mirzapur, moderate at Hamirpur, light at Kanpur and rare in Bahraich. The variety *Mauranipur* showed the least infection at all the four places. Linseed, Type 1, showed tolerance to the disease at Hamirpur and Bahraich, but at Kanpur it was moderately affected and at Mirzapur seriously.

Seed Certification—How it Functions in U.S.A.

By

T.B. Lal

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BOMBAY

IN the U.S.A., Seed Certification is a co-operative under-taking whereby various agencies work together as a team with a view to producing and making available high quality seed to American agriculture. By high quality seed is meant the seed that s ows varietal purity, good germination, freedom from noxious weed seeds and freedom from or resistance to diseases. The various organisations actively concerned in this work and their responsibilities are stated as follows :

State Agricultural Experiment Stations have the vital role in Seed Certification programme. They evolve new crop varieties and determine their field performance. State and Federal research workers assist in developing certification standards for crops to be certified by official seed certifying agencies. State Experiment Stations are further responsible for maintaining breeders' seed for subsequent multiplication as Foundation, Registered, and finally Certified seed.

State Agricultural Extension Services train and encourage qualified growers to produce high quality seed of upto-date varieties, keep seed users informed of the performance of recommended varieties and provide liaison between seed growers and dealers and between seed dealers and users for the common purpose of serving agriculture with the best seed of modern varieties. In many States, the Extension workers also assist in determining eligible varieties and certification standards and training inspectors.

State Crop Improvement Associations are, as a rule, the certifying agencies. These are organisations of seed growers whose purpose is to maintain and make avaiable, through certification, high quality seeds and propagating materials of superior crop varieties so grown and distributed as to ensure genetic identity and purity. Although Crop Improvement Associations are concerned largely with seed certification, they augment many of the activities of the Agricultural Extension Service by providing educational exhibits, seed shows and in many other ways.

State Departments of Agriculture have relationship to seed certification or certified seed, in as much as they are responsible for the enforcement of seed laws. In some cases, the State Department also conducts the Inspection and seed certification work.

International Crop Improvement Association is composed of 38 member agencies located in Canada and the U.S.A. The purpose of the I.C.I.A. is to assist individual certifying agencies to improve and standardize seed certification requirements so that all certified seed will meet satisfactory minimum standards of excellence.

U.S. Department of Agriculture has no direct relation with seed certification, but indirectly it aids in the breeding, testing and development of superior field crop varieties through various research facilities in co-operation with State Experiment Stations. Indirect relationships of seed certification also exist with the Foundation Seed Project for improved forage crop varieties and the Federal Seed Act.

State & National Seed Trade Organisations assume, by means of interstate certification activities, a large responsibility not only in the distribution of certified seed but also in the services to their members to bring about a clearer understanding of seed certification and in properly fitting their facilities into the better seed programme of seed certification. The seed trade is handling an increasing volume of certified seed, notably of cereals, legumes and grasses.

The four steps in the production, multiplication and distribution of improved crop varieties may be summarized as follows :—

1. The plant breeders of the State Agricultural Experiment Stations, together with commercial plant breeders, develop new varieties and supply a limited quantity of breeders seed for further multiplication.

2. The foundation seed organisation increases the breeders' seed to a larger volume which is designated as 'Foundation seed'.

3. The 'Foundation seed' is then distributed to seed growers who increase the seed as Registered or directly to large volume as Certified under certification requirements. Such seed is then made available to the public through normal seed trade channels.

4. The Agricultural Extension Service, including county extension agents and crop specialists, are responsible for seeing that farmers are kept informed of new varieties and of their adaptation.

The success of a seed improvement programme depends upon the above four links and failure in any one of these adversely affects the programme. Whether the State certification agency be a self supporting, non-profit organisation or it be a responsibility of the State Department of Agriculture or the State Agricultural Extension Service, the work is usually integrated with Agricultural Experiment Stations that are developing improved varieties of crops. Seed certification programmes are, therefore, regarded as an authorised educational function of the various State Experiment Stations and practical means of conveying to the farmer the progress made in the development of better crops.

Insecticide Dust Diluents

By

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The following are the major groups of minerals from which dust diluents are derived.

1.	Oxides :—	Silicon, Calcium and Magnesium.
2.	Carbonates :—	Limestone and Dolomite.
3.	Sulphates :—	Gypsum.
4.	Silicates :—	Talc, Pyrophyllite, China Clay, Bentonite and Fuller's earth.
5.	Phosphates :—	Apatite.

OF these, the silicates are used to the largest extent. Some of the silicates may again be grouped under clays. These are said to possess the following qualifications : (1) They are natural materials with plastic properties ; (2) they are made up essentially of particles of very fine grades or occasionally of hydrous magnesium silicates. They vary from acid to alkaline in reaction. The clays which are used as diluents may further be divided into two groups viz., those like Kaolinite and those like Bentonite. The Kaolinite group includes various China clays (also utilised in the manufacture of Chinaware) and Kaolins. They vary somewhat between granular and plate like particles but they are never spicular or fibrous. They are poorly absorbent and low in base exchange. Their density is 15 to 20 lbs./cu. ft. and they are generally less free flowing than talc or pyrophyllite. Those belonging to the Bentonite group swell on the addition of water and have a laminated structure and are high in base exchange and adhesive properties. Although Bentonite is mainly aluminium silicate, a variety of other bases may be present depending on the source of the material. Bentonite is highly colloidal in nature and produces a gelatinous paste with 7 to 10 parts of water, and a flowable solution with 15 to 20 parts. No swelling occurs in organic solvents like alcohol or gasoline. The use of Bentonite is best limited to adhesive purposes. Fuller's earth is another well known diluent similar in chemical composition to Bentonite. It is nearly neutral in reaction.

Talc also known as soapstone or steatite in its solid form is essentially a metasilicate of Magnesium (H_2O 3Mgo $4SiO_2$) and therefore closely related to the clays. The grades used are rather abrasive because of the quartz particles contained as impurities. The pure mineral is barely harder than talc which is accepted as the softest of all the minerals.

The *carbonates* that are commonly used are those of calcium and magnesium. Calcium carbonate is used alone in the form of finely ground limestone or together with Magnesium carbonate as in dolomite limes. The use of calcium carbonate is rather limited because of its high bulk density. The density of ground limestone is 50 to 75 lbs. per cu. ft. Being alkaline (pH about 8) Calcium carbonate reacts with acidic material.

Gypsum ($CaSO_4$ $2H_2O$) is the only mineral sulphate used as diluent. It is chemically stable, neutral and inert towards insecticides mixed with it and not subject to atmospheric deterioration. It is characterised by its high bulk density (30 to 40 lbs. per cu. ft.), granular nature and high flow rate. The material should not be coarser than 325 mesh, preferably it should be 400 mesh.

It is gathered that some of the leading firms are using various grades of talc, pyrophyllite and China clay in their insecticide formulations.

India has good deposits of most of the inert carriers. The localities where these materials occur in India and their annual output and value is given below. These data have been abstracted from 'The Mineral Production of India during 1952'– M.S. Krishnan, Director, Geological Survey India and Records of the Geological Survey of India Vol. 84, part 2, 1953.

1. *Oxides.* Silica occurs very widely. Figures for the production of calcium and magnesium oxides are not available as they are derived by calcining limestone and magnesium carbonate.

2. *Carbonates.* Limestone occurs very widely and quarries have been opened in almost every state except Bengal.

3. *Sulphates.* Gypsum or calcium sulphate is used as an inert carrier. Supplies of this are obtained chiefly from the districts of Bikaner, Jodhpur and Jaisalmer in Rajasthan, Madras and Saurashtra. Deposits are also known to occur in Uttar Pradesh, Sirmur in Himachal Pradesh, Rewa in Vindhya Pradesh, Cutch and Bhutan. The total reserves are estimated at 67 million tons, the share of Trichinopalli in Madras being about 15 4 million tons, that of Bikaner, Jodhpur and Jaisalmer about 40 million tons and of Saurashtra, Cutch and Himachal Pradesh about 11.5 million tons. (Eastern Metal Review-Annual Number February, 1954).

Output and value of Gypsum (1952)		*Tons*	*Value (in Rs.)*
Madras	Trichinopalli	49,797	7,88,673
Rajasthan	Bikaner	2,13,276	16,02,119
	Jodhpur	1,42,849	6,52,136
Saurashtra		4,793	55,000

4. *Silicates*

(a) Clays. As in most countries India has ample resources of clay. There are workable deposits of China clay in almost every state. Those of fireclay and other clays are also widespread.

Output and value of China clay (1952)	*Tons*	*Value (in Rs.)*
Bengal	186	3,720
Bihar	29,548	11,64,984
Delhi	508	10,901
Madhya Pradesh	3,670	29,540
Madras	9,914	69,725
Mysore	20,946	1,75,940
Orissa	4,425	1,62,668
Saurashtra	9,495	1,42,425
Travancore-Cochin	2,130	48,990
Vindhya Pradesh	529	13,351
Total	81,351	18,22,244

(b) *Steatite.* (Generally well known as talc in its powdered form). Deposits are widespread in India. They are known to occur in various localities in Bihar, Madhya Pradesh, Madras, Mysore, Rajasthan, Uttar Pradesh and Kashmir.

Output and value of steatite (1952)		*Tons*	*Value (in Rs.)*
Bihar	Harzaribagh	743	46,900
	Singhbhum	1,194	19,397
Hyderabad		58	9,959
Madhya Pradesh	Jabalpur	1,321	79,547
Madras	Anantpur	298	10,740
	Kurnool	289	15,545
	Nellore	14	1,740
Mysore	Hassan	133	15,590
	Tumkur	63	378
Orissa	Mayurbhanj	567	3,412
	Nilgiri	...	...
Rajasthan	Jaipur	317	7,925
	Girwa	175	3,500
	Mewar	14,877	5,35,971
Uttar Pradesh	Jhansi	2	160

(c) Fuller's earth. The term is applied to non-plastic clays which have the power of absorbing grease and oil. India's supply is mainly obtained from Rajasthan, Madhya Pradesh and Mysore States.

Output and value of fuller's earth. (1952)		*Tons*	*Value (in Rs.)*
Madhya Pradesh	Jabalpur	25	353
Rajasthan	Jodhpur	120	1,800

5. *Phosphates.*

Apatite is the commonly used mineral of the group. Only a small output of phosphate is obtained from Trichy in Madras and Singhbhum in Bihar. The reserves in Trichy are estimated at 2 million tons up to a depth of 50 ft. from the surface. The deposits in Singhbhum are in the form of lodes and veins, often mixed with magnesite and occur intermittently for a distance of 40 miles between Dhad-Didih in Seraikela and Khejurdari in Dalbhum (Singhbhum).

Output and value of apatite. (1952)		*Tons*	*Value (in Rs.)*
Madras	Trichinopoly	445	6,940

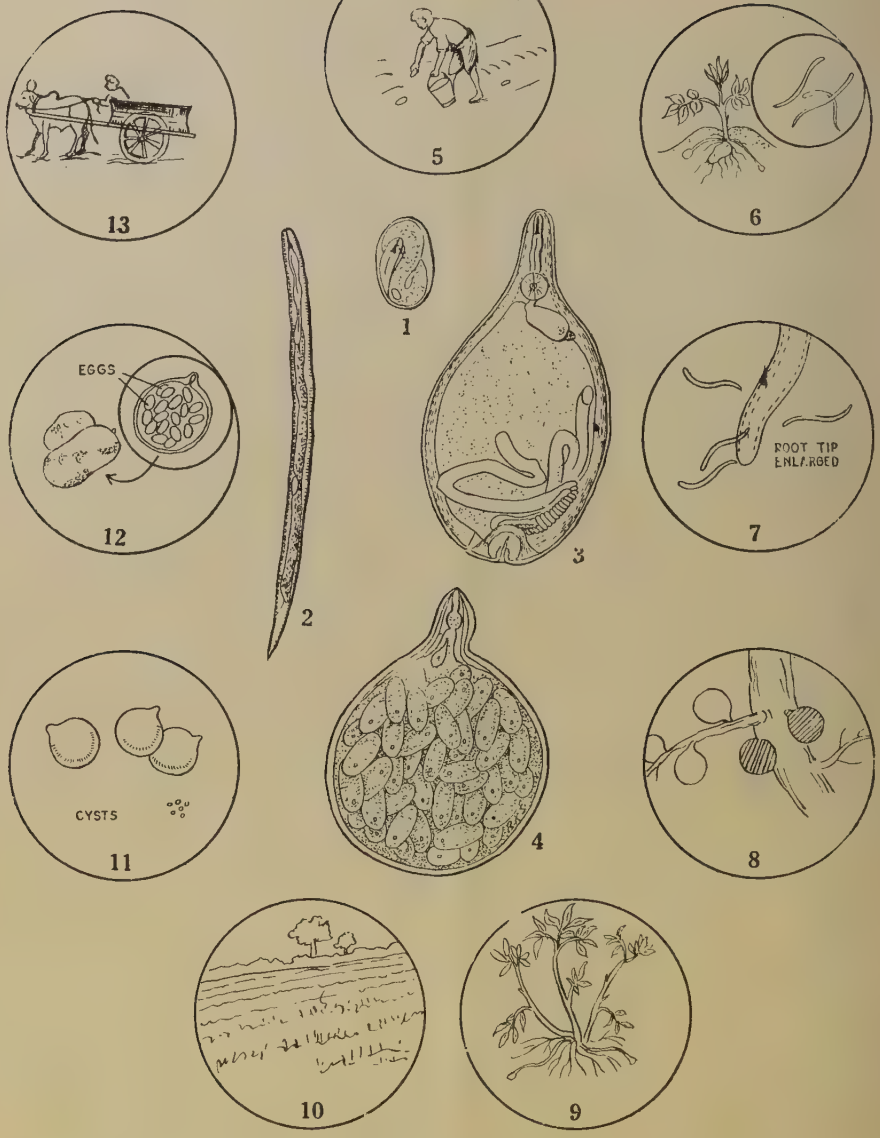

Plate I

Life cycle of the Golden nematode, *Heterodera rostochiensis* Wollen

Fig. 1. Egg with developed embryo. Fig. 2. Larval stage of the female. Fig. 3. Adult female (figs. 1 to 3 after Chitwood and Buhrer). Fig. 4. Adult female with eggs (after O'Brien and Prentice). Fig. 5. Cyst contaminated seed is sown on clean land or clean seed on infested land. Fig. 6. The eelworms hatch and break out of the cysts when the potatoes begin to grow. Fig. 7. Young worms bore into the roots and kill them. Fig. 8. On the roots female eelworms form white cysts which turn yellow and then brown. Fig. 9. Badly infested plants are stunted and have many extra fibrous roots. The lower leaves turn yellow and drop off. Fig. 10. The plants die off where the soil is very heavily. infested. Fig. 11. When the potatoes are lifted, the majority of the cysts remain in the soil. Fig. 12. But the soil adhering to the tubers will also contain a few cysts. Fig. 13. Clean land may become contaminated with infested soil carried on footwear, implements, vehicles, hooves of animals, jute bags, containers, baskets, etc., used in infested fields. (Figs. 5 to 13 after Dillon Weston).

A Warning to Potato Growers and Importers in India

By

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Introduction

THE potato crop must receive protection not only from the depredations of pests and diseases within India which cause considerable damage, but also from foreign pests and diseases which may be introduced into the country. India is already suffering losses due to the introduced foreign pest, the potato tuber moth, which is believed to have entered India along with imported seed potato about 1905. The existence and spread in other countries of at least two other destructive pests and a disease of potato, namely (i) Golden Nematode, *Heterodera rostochiensis* Wollenberger and (ii) Colorado beetle, *Leptinotarsa decemlineata* Say and (iii) Wart disease, *Synchytrium endobioticum* (Sehilb) Perc. and the enormous losses they have caused must be a warning to India. Every effort should be made to keep them out, because their entry would mean the ruin of our potato industry The following ac ount of the above mentioned two pests and the disease is therefore, given to enable potato growers as well as importers in India to know something of them and to appreciate the reasons for the efforts being made to prevent their entry into this country.

1. Golden Nematode

The Golden nematode or the potato root eelworm, as it is commonly called in Europe, is the most destructive of all pests attacking potato. It is almost microscopic in size, at first eel like in shape (fig. 2, Plate I), thin as the finest hair and less than 1/50 of an inch long. On account of the minute size of the worms, their presence goes undetected until the result of their feeding b ecomes evident. By that time they have not only increased in vast numbers but have also spread to neighbouring fields. Thousands of them may attack the roots of a single potato plant, in heavily infested soils. On reaching maturity, the males copulate with the females and then die but the females embed themselves in the outer layer of the rootlets (fig. 8, Plate I) and develop ultimately into spherical cysts with one end slightly pointed, about 1 mm. in diameter, and white, cream, yellow, orange or brown in colour according to their age. These cysts may, however, be seen with the naked eye when examined carefully (fig. 11, Plate I). The mature cysts, which contain about 200 eggs each, usually get detatched from the roots and remain like weed seeds in the soil until a new crop of potatoes is available for them to feed on. When potatoes are again planted, a substance exuded from the roots stimulates the hatching of a new generation of nematodes. On Plate I is a pictorial diagram of the life cycle of the Golden nematode.

The Golden nematode causes what is called the "potato sickness". In badly attacked fields the whole crops are poor, the tops die off prematurely while the roots produce a very poor yield of potatoes. Plants attacked by the worm are stunted, appear like feather dusters and show a wilting of the lower leaves, only the tips or growing points remaining green while the root system is a mass of fibrous roots (fig. 9 Plate I). The Golden nematode was first discovered in England in 1921 but is believed to have been present in the British Isles since 1900. It now infests 65 to 75% of the potato fields in the more important potato growing areas and potatoes cannot be grown profitably in soil heavily infested by it. In Scotland it is reported to occur wherever potatoes are grown commercially. In Northern Ireland although not widely distributed, its occurrence is known. In Holland, limited areas are infested but are being dealt with drastically. Both Northern Ireland and Holland have arranged for the issue of export certificates only to potatoes grown in eelworm-free soil in order to protect their seed potato export industry. The nematode is also known to be present in Sweden and Northern Germany but very little is known about the damage it does in other countries of Western Europe. More recently it has been found in Algiers, Spain, Mexico and Peru. In U.S.A. damage due to the eelworm was first seen at Hicksville in Long Island in 1934 but it was not till 1941 that the actual occurrence of the pest was definitely established. In that year only about 40 acres were known to be infested. But on account of water draining from infested fields on to others or by soil carried with farm implements, trucks and containers such as baskets, jute bags exchanged between infested and non-infested areas, nearly 2,600 acres of potato land in Nassau County in Long Island of New York State are infested by the eel worm and constitute a threat not only to the potato industry of U.S.A. but also of Canada. Every effort is, therefore, being made by the authorities in U.S.A. to prevent the spread of the pest. A restriction has been placed on the movement of seed potatoes and soil from the infested area. An intensive campaign of soil fumigation with fumigants, like Dichloropropene Dichloropane (DD), Carbon disulphide, Chloropicrin, a compound of 90% Propylene dichloride and 10% Methyl bromide (Dowfume P) and various other soil fumigants, at an enormous cost has been in progress. Although a high degree of control has been obtained, it has not been possible to eradicate the pest even when the dosages have been considerably increased.

The Golden nematode after escaping from a cyst into the soil can only travel a short distance by itself. The soil from highly infested fields may have as many as 10 cysts per 10 grams. The most important means of spread of cysts is through soil adhering to seed potatoes when they are moved from one part of the country to another or from one country to another. Transplants like those of cabbage and celery also carry soil from one place to another. Soil with cysts may be spread in trucks and other vehicles, by farm implements, foot wear, or through containers such as baskets and jute bags, exchanged between infested and uninfested areas or countries.

2. Colorado Beetle

The Colorado beetle was first collected in the upper Missouri region in U.S.A. in 1820. It gained economic importance in 1859 when it was noticed as a serious pest of potatoes in Nebraska. It spread from one potato growing section to another at an average annual speed of about 85 miles a year. By 1874, it had reached the Atlantic coast and also ultimately spread into Canada. Carried by importations of potatoes from America, it was apparently established in a very limited area in Germany in 1874—75. This area was given a very drastic clean up and further importation of potatoes including packing,

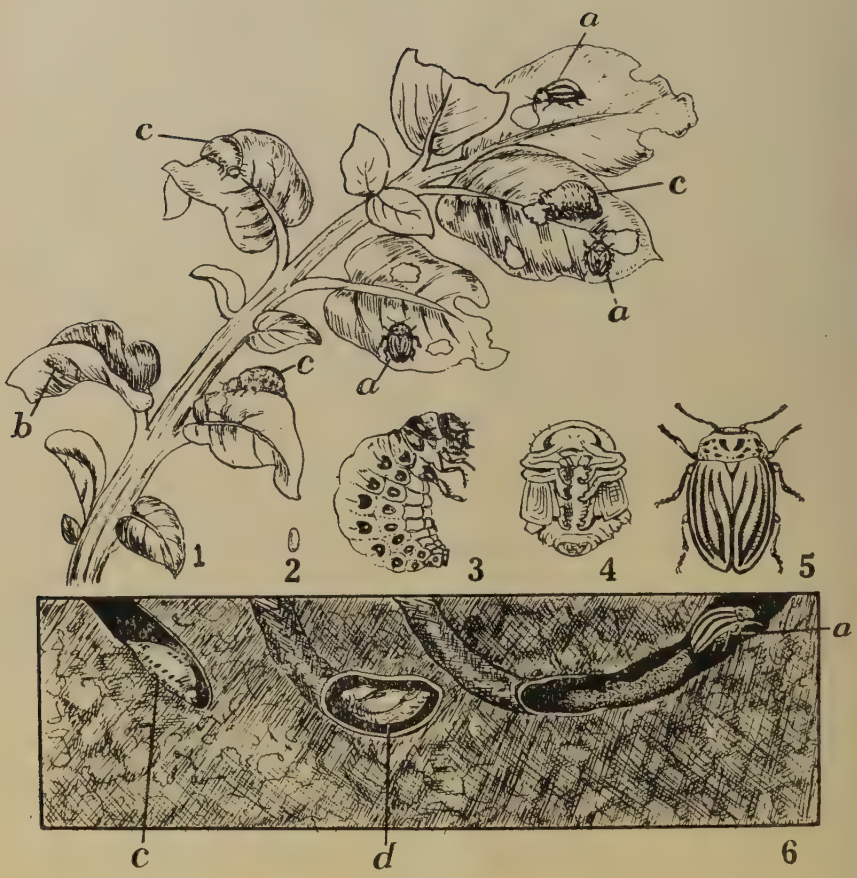


Plate II

COLORADO BEETLE, *Leptinotarsa decemlineata* say

Fig. 1. A branch of a potato plant showing eggs (b) laid on the underside of a leaf and grubs (c) and adults (a) feeding on other leaves. Fig. 2. Egg. Fig. 3. Grub (Side view). Fig. 4. Pupa (Ventral view). Fig. 5. Adult (Dorsal view). Fig. 6. Section of the soil showing a grub (c) about to pupate, a pupa (d) and an adult to emerge from the soil.

sacks, etc., was absolutely forbidden by the decree of February 26, 1875. A minor outbreak was also discovered in England about 1901-2 but was eradicted. During the first world war the beetle accompanied potatoes shipped to the American expeditionary forces in France and firmly established itself there and spread to several countries of Europe like Switzerland, Austria, Belgium, Czechoslovakia. Denmark, Hungary, Yugoslavia, Italy, Germany, Luxemburg, Lichtenstein, Netherlands, Portugal, Spain, Poland and England. England has been making efforts to keep off further importation of the insect and eradicate it, wherever it appears.

The adult of the Colorado beetle is about 3/8" long and ¼" wide (fig. 5, Plate II). It is a very convex, nearly hemispherical beetle, yellow in colour, with black spots on the prothorax and 5 black stripes on each wing cover. The adults are very hardy and are able to survive winter buried deep in the soil (fig. 6, Plate II) generally upto a depth of 8 to 10 inches. As soon as the spring comes the beetles emerge out of the ground and attack the shoots of early planted potato. Potato is the favourite of the insect but when this is not found, it can live on tomato, brinjal, tobacco, chilli, ground cherry, thorn apple, jimsom weed, henbane, horse nettle, belladona, petunia, cabbage, thistle, mullein and a few other plants. The female beetle lays on an average as many as 500 to 1,000 eggs on the underside of leaves in the course of 4 or 5 weeks. The adults then die. Meanwhile, the eggs hatch and small, humpbacked, orange-reddish grubs emerge and attack the leaves. They are gregarious and consume the leaves and terminal shoots completely. Fig. 1 on Plate II shows nearly full grown grubs feeding on a potato shoot. The grubs become full grown in about 20 days and pupate in the soil (fig. 6, Plate II). As both the grubs and adults feed voraciously on the potato leaves and shoots, the plants die without developing tubers.

The Colorado beetle is a strong flier. It is this ability that enabled the pest to quickly spread across the United States, probably aided by commerce also. Adult beetles have been collected even from the decks of ships arriving at ports in England from America. Sometimes, shoots of potato plants are used in some places to close the tops of sacks and other containers having potatoes. This has also probably enabled the pest to spread.

3. Wart disease

This is a destructive disease of potato, caused by the fungus *Synchytrium endobioticum* (Schilb.) Perc. It was first described in Hungary in 1896, but it is now common in most European countries and has also been reported locally from North and South America, and South Africa. Several countries are apparently yet free from this menace. Among these are Japan, China, Burma, Indonesia, Australia, etc. In India, the wart disease appeared as a result of accidental introduction in 1953, in a small plot (about 1/10 of an acre) in Darjeeling, on an imported variety of seed potatoes. Immediate steps were taken for its complete eradication and for preventing its spread to any new area. The disease has not been known to occur any where in India since then.

Symptoms : The disease appears on all underground parts except the roots and is characterized by the development of greenish-yellow warts of variable size, mostly on the tubers. These later darken in colour and eventually decay. The warts develop as a result of abnormal growth of the host tissue near an infected cell and may be very small protruberances or large cauliflower-like masses involving most of the tuber. Numerous thin-walled sporangia are produced in the host cells. These liberate zoospores which can reinfect the host directly, or motile gametes which fuse in pairs before doing so. Resting spo-

rangia are later developed. These are thick-walled, brownish-black, spherical and about 52μ (hardly 0.05 mm.) in diameter. As the warts decay, the resting sporangia pass into the soil. After a period of rest and in the presence of enough soil moisture, these germinate and numerous motile zoospores are liberated. These infect the young tubers through the 'eyes' or the stolons. On tubers this results in the formation of warts. The resting sporangia may remain viable in the sail for many years. Instances are known in which wart disease has appeared in a crop grown in land known to have been contaminated but in which no potatoes had been grown for periods of 8 to 12 years.

The disease is spread through the use of diseased tubers, or through contaminated soil or manure. Dung from animals such as geese and pigs fed with raw warty tubers may also be source of spread of the disease.

There are no economical and effective methods of destroying the resting sporangia in the soil. Even resistant varieties may not always be safe to recommend. In some of the moderately resistant varieties the warts may be so small as to be overlooked, but these may be effective enough to spread the pathogen. Great vigilance is therefore necessary in importing foreign varieties of patatoes, to avoid any recurrence of the disease in India. Imported seed-potatoes (especially from countries where wart disease exists), should preferably be grown under quarantine conditions in different climatic regions, for detection of any latent infection. The crop should be examined periodically for the presence of the disease, and if found healthy, the resultant seed alone should be distributed for large-scale propagation.

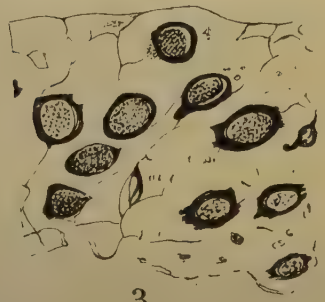
As a safeguard against the introduction and spread of the Golden nematode, Colorado beetle and the wart disease, many countries have imposed various degrees of restrictions, some completely prohibiting the importation of potatoes. The quarantine working party appointed in 1951 by the European Plant Protection Organisation reported that the prohibition of entry of potatoes into the countries which are free from the wart disease and the Golden nematode is justifiable. With a view to preventing entry of these two pests and the disease into this country, the following rules have been framed by the Government of India :

"Potatoes, other than potatoes from Burma, shall not be imported into India by sea, except through the port of Bombay or Madras, unless such potatoes are inspected and, if necessary, fumigated and disinfected by the Plant Protection Adviser to the Government of India or any person duly empowered by him in this behalf at the port of Bombay of Madras and certified by him to be free from pests and diseases and are also accompanied by—

(a) a certificate from the consignor stating fully in what country and in what district of such country the potatoes were grown and

(b) an official certificate stating—

(i) that no case of wart disease (*Synchytrium endobioticum*) of potatoes or the existence of the pests, Golden nematode (*Heterodera rostochiensis*) and Colorado potato beetle (*Leptinotarsa decemlineata*) in any stage of development has occurred at any time during twelve months preceding the date of the certificate within five miles of the place where the potatoes included in the consignment were grown ;



3

4

Plate III

WART DISEASE OF POTATO, *Synchytrium endobioticum* (Schilb.) Perc.

1. A potato plant attacked by wart disease. The top has been cut off.
2. Warts on potato tuber.
3. *Synchytrium endobioticum*, resting sporangia in cells of wart. Highly magnified.
4. [illegible] view of a [illegible] sporangium. Highly magnified.

(ii) that the crop from which the potatoes were derived was officially inspected in the field and that the degree of freedom from virus diseases was sufficiently high to ensure the suitability of the progeny for seed purposes and that the said crop was not grown in the vicinity of any unhealthy potato crop ;

(iii) that a representative sample of potatoes included in the consignment was thoroughly examined and found to be healthy and there was no tevidence ih it of the presence of any insect pest or fungus destructive to agricultural and norticultural crops;

(iv) that the potatoes included in the consignment are free from Colorado beetle, Golden nematode and wart disease.

Provided also that potatoes may be imported under a certificate from the Head of Division of Botany, Indian Agricultural Research Institute, or the Plant Protection Adviser to the Government of India, or the Director, Central Potato Research Institute".

Rules Framed by the Governments of Bombay, West Bengal, Madras and Travancore-Cochin, Under the Destructive Insects and Pests Act, 1914, For Detention, Inspection, Fumigation and Destruction of Plants and Plant Products.

The following rules framed in exercise of the powers conferred by section 5 of the Destructive Insects and Pests Act, 1914, by the State Governments of Bombay, West Bengal, Madras and Travancore-Cochin, are published for information :

GOVERNMENT OF BOMBAY

Agriculture and Rural Development Department,
Bombay Castle, 5th November, 1948.

Destructive Insects And Pests Act, 1914.

No. 431-II—In exercise of the powers conferred by section 5 of the Destructive Insects and Pests Act, 1914 (II of 1914) the Government of Bombay is pleased to make the following rules, namely :—

Short title and extent :—(1) These rules may be called Bombay Infected Articles (Detention, Inspection, Disinfection and Destruction) Rules 1948 ;

These rules shall apply to the Port of Bombay.

(2) *Definitions* :—In these rules unless there is anything repugnant in the subject or context :—

(a) "Act" means the Destructive Insects and Pests Act 1914 ;

(b) "Infected article" means any article in respect of which a notification has been issued by the Central Government under section 3 or 4A of the Act or any articles which may have been in contact or proximity thereto.

(3) *Powers of detention, inspection, disinfection and destruction* :—The Collector of Customs Bombay or any other officer authorised by him in this behalf, may :—

(i) seize and detain any article which he believes to be an infected article ;

(ii) seize and detain for purposes of inspection any package suspected by him to contain infected article and require such package to be unpacked ;

(iii) take steps for disinfection if the infected article is susceptible of being disinfected ;

(iv) Destroy any infected article which in his opinion cannot be disinfected provided that such destruction shall not be carried out except in the presence of a Gazetted Officer.

4. *Penalty* :—(1) No person shall deal with or remove or dispose of any infected article or article suspected to be an infected article otherwise than in accordance with a direction of the Collector of Customs or any other officer authorised by him in that behalf.

(2) Any person who contravenes the provisions of sub-rule (1) shall on conviction be punished with fine which may extend to one thousand rupees.

GOVERNMENT OF WEST BENGAL.

Department of Agriculture, Forest and Fisheries. Agriculture.

Notification.
No. 8652-Agri.
Calcutta, dated the 24th Nov., 1949.

In exercise of the powers conferred by section 5 of the Destructive Insects and Pests Act, 1914 (II of 1914) the Governor is pleased to make the following rules, namely :—

1. *Short title and extent* :—(1) These rules may be called the West Bengal Infected Articles (Detention, Inspection, Disinfection and Destruction) Rules, 1949.

(2) These rules shall apply to the Port of Calcutta.

2. *Definitions* :—In these rules, unless there is anything repugnant in the subject or context :,—

(a) "Act" means the Destructive Insects and Pests Act, 1914 (II of 1914) ;

(b) "Infected Article" means any article in respect of which a notification has been issued by the Central Government under Section 3 or 4A of the Act. or any article which may have been in contact or proximity thereto.

3. *Power of detention, inspection, disinfection and destruction* :—The Collector of Customs, Calcutta or any other officer authorised by him in this behalf may :—

(i) seize and detain any article which he believes to be an infected article ;

(ii) seize and detain for purposes of inspection, any package suspected by him to contain infected article and require such package to be unpacked ;

(iii) take steps for disinfection, if the infected article is susceptible of being disinfected ;

(iv) destroy any infected article which in his opinion, cannot be disinfected ; provided that such destruction shall not be carried out except in the presence of a Gazetted Officer.

4. *Penalty* :—(1) No person shall deal with or remove or dispose of any infected article or article suspected to be an infected article, otherwise than in accordance with a direction of the Collector of Customs, Calcutta or any other officer authorised by him in that behalf.

(2) Any person who contravenes the provisions of sub-rule (1) shall on conviction be punishable with fine which may extend to one thousand rupees.

GOVERNMENT OF MADRAS

Food and Agriculture Department

G.O.Ms. No. 1445. Dated 26th July, 1950.

Notification

In exercise of the powers conferred by Section 5 of the Destructive Insects and Pests Act 1914 (Central Act II of 1914) His Excellency the Governor of Madras hereby makes the following Rules :—

Rules.

Short title and application : (1) These rules may be called the Madras Infected Articles (Detention, Inspection, Disinfection and Destruction) Rules, 1950.

(2) These rules shall apply to the following Ports in the Madras State namely Dhanushkodi, Madras, Nagapattinam, Tuticorin and Visakhapatnam.

2. *Definitions* : In these rules, unless there is anything repugnant in the subject or context,—

(a) "Act" means the Destructive Insects and Pests Act, 1914 (Central Act II of 1914).

(b) "Infected Article" means any article in respect of which a notification has been issued by the Central Government under section 3 or 4A of the Act or any article which may have been in contact therewith or proximity thereto.

3. *Power of detention, inspection, disinfection and destruction.* The Collector of Customs, Madras or any other officer authorised by him in this behalf, may

(i) seize and detain any article which he believes to be an infected article ;

(ii) seize and detain for purposes of inspection any package suspected by him to contain infected article and require such package to be unpacked ;

(iii) take steps for disinfection if the infected article is susceptible of being disinfected ;

(iv) destroy any infected article which in his opinion cannot be disinfected ; provided that such destruction shall not be carried out except in the presence of a Gazetted Officer of the Agricultural Department.

4. *Penalty.* (1) No person shall deal with or remove or dispose of any infected article or article suspected to be an infected article otherwise than in accordance with a direction of the Collector of Customs, Madras or any other officer authorised by him in that behalf.

(2) Any person who contravenes the provisions of sub-rule (1) shall, on conviction, be punishable with fine which may extend to one thousand rupees.

GOVERNMENT OF TRAVANCORE-COCHIN.

Notification

No. A. 3-5645/51/Fd. D. 13th August, 1953.

In exercise of the powers conferred by section 5 of the Destructive Insects and Pests Act, 1914 (Central Act II of 1914) the Government of Travancore-Cochin hereby make the following rules.

RULES

1. *Short title and application*: (1) These rules may be called the Travancore-Cochin Infected Articles (Detention, Inspection, Disinfection and Destruction) Rules, 1953.

(2) These rules shall apply to the following ports in the State of Travancore-Cochin viz., Cochin, Allepey, Quilon, Koilthottam, Trivandrum, Colachel.

2. *Definitions* : In these rules unless there is anything repugnant in the subject or context :—

(a) "Act" means the Destructive Insects and Pests Act, 1914 (Central Act II of 1914) ;

(b) "Infected Article" means any article in respect of which a notification has been issued by the Central Government under Section 3 or 4A of the Act or any article which may have been in contact therewith or proximity thereto.

3. *Power of detention, inspection, disinfection and destruction :* The Collector of Customs, Cochin or any other officer empowered by him in this behalf so far as the Cochin Port is concerned and the Collector of Central Excise, Madras or any other officer duly authorised by him in this behalf for the minor ports of the State may :—

(1) seize and detain any article which he believes to be an infected article;

(ii) seize and detain for purposes of inspection any package suspected by him to contain infected article and require such packages to be unpacked;

(iii) take steps for disinfection if the infected article is susceptible of being disinfected;

(iv) destroy any infected article which in his opinion cannot be disinfeced, provided that such destruction shall not be carried out except in the presence of a Gazetted Officer of the Agricultural Department.

4. *Penalty* : (1) No person shall deal with or remove or dispose of any infected article or article suspected to be an infected article otherwise than in accordance with a direction of the empowered officer or any officer authorized by him in that behalf.

(2) Any person who contravenes the provisions of sub-rule (1) shall on conviction be punishable with fine which may extend to one thousand rupees.

Wheat Rusts Situation in India During the Year 1953-54

Jammu & Kashmir*

All the three rusts were obsesved in the State. The common varieties under cultivation were NP-4, NP-120, C. 591 and local.

The Punjab (K. S. Bedi)[1]

The three rusts of wheat, viz., yellow, brown and black, were present. Yellow rust was the first to appear in Ludhiana and Gurdaspur. It occurred in a very virulent form in Ambala, Gurdaspur, Amritsar and Hoshiarpur districts, and in a less severe from in Ludhiana, Jullundur, Ferozepur, Karnal, Hissar and Rohtak districts. Of all the rusts it caused the greatest amount of damage to the crop. The average percentages were 100%, 60% and 20% respectively for the yellow, brown and black rusts. There was no *kharif* cultvation of wheat or barley crop in the Punjab State except at Lahul on a very small acreage.

The weather before the outbreak of rust in the humid submontane districts of the Punjab remained very cold and foggy. There was heavy fall of dew during the period from January to February 1954.

Wheat varieties C.518, C. L 591, 8A, and 9D were severely attacked by yellow rust, while the wheat varieties C. 273, C. 250 and C. 228 were much less affected by it.

Uttar Pradesh (R. S. Mathur)[2]

All the three rusts viz. yellow, brown and black occurred on the wheat crop in the plains and hills of Uttar Pradesh. The yellow rust appeared by the middle of January and was fully established by the first week of February. It was severe in hill and sub-montane (*tarai*) regions and was moderate in the districts of Bijnor, Ninital and Hamirpur. In Shahjahanpur, Mathura, Kanpur, Ghazipur and Jaunpur, the infection was mild. Brown rust also appeared by the second weak of January and became quite widespread and severe in most districts of the State by the second week of February. For the past decade or two such unprecedented severity of brown rust was not observed in the State. Black rust was severe in Etah, Barabanki and Banda districts and moderate in all other districts. At most places it appeared by the second week of February.

The weather conditions during January and February in general were quite favourable for the development of rusts, specially brown rust.

Amongst the prevalent varieties, severe infection of yellow rust was observed in varieties C. 221 and NP-52 and moderate infection on NP-165, NP-710, Pb. 591 and *kathia*. Varieties C. 13 and Bansi CP escaped with mild infection. Nearly all the prevalent varieties suffered from moderate to severe infection of brown rust. NP. 710 showed mild infection of black rust whereas other prevalent varieties showed moderate to severe infection.

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* Report received from the Director of Agriculture.

1. Plant Pathologist, Punjab, Government Agricultural College, Ludhiana.
2. Plant Pathologist to Government, Uttar Pradesh, Kanpur.

Bihar (J. N. Mishra)[3]

All the three rusts, viz. brown, yellow and black appeared on wheat during the year. The brown rust appeared first and was noticed in early January. It was serious in the humid regions of North Bihar which is also close to the Himalayas. In South Bihar the rust was not serious. The average loss in yield due to the rust may be estimated at 6 to 8%. The yellow rust appeared after about a fortnight when the plants were about to flower. The loss due to this rust may be estimated at about 2%. The black rust appeared much later when the grains were formed and was the least damaging. The loss due to this rust may be estimated at about 0.5%. Both the local and improved wheats were found infected and no difference in resistance was noted. There were a few light showers during the season when the grains were setting.

Madhya Bharat (B. G. Nikam)[4]

During the year all the three rusts were present.

In the Northern Division, the local vulgare, Pipandi white, Banda Sharbati, Pb. C. 518 and C. 591 and the local durum wheats were principally grown. There was moderate rainfall in January and February (1.72"), and the average mean temperatures in the months of December 1953, January 1954 and February 1954, were 64.9°F., 60.6°F. and 68.4°F, respectively. The yellow and brown rusts appeared early in February when the plants were in tillering stage and the attack was very severe in 'boot' stage, particulary in Bhind, Gird, Morena and Bhilsa districts. The black rust appeared a month later when the plants were in the flowering stage.

In the Southern Division, the local Malvi, Durum, Eakdania, Jelaliya, G.D. 11, Niphad, Pb. C. 591 and local vulgare types were grown. There was no rain and the average mean temperatures were 70°F., 68°F. and 77°F. respectively. Only black rust appeared in traces on 24-2-1954 in the flowering stage.

Madhya Pradesh (R. P. Asthana)[5]

This year, the incidence of rusts on wheat in the State was casual and late. It was observed that at some places where the wheat crop stood in wet soils and under irrigation, the black and yellow rusts appeared but at a late and maturity stage.

Weather remained dry from December 1953 to April 1954 due to lack of rains. Wheat crop did not suffer any appreciable damage.

First appearance of black rust was reported from Pimpalgaon (district Buldana) on 8-2-1954. In Nagpur, rust incidence was recorded on 18-3-1954 on hybrids 11 and 65-4, the newly evolved varieties, sown under irrigation after the harvest of paddy crop.

Yellow rust was collected in Niwas, Mandla and Jabalpur.

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3. Plant Pathologist, Government Agricultural College, Sabour, Bihar.
4. Plant Pathologist, Department of Agriculture, Gwalior, Madhya Bharat.
5. Mycologist, Department of Agriculture, Nagpur, Madhya Pradesh.

Bombay (M. K. Patel)[6]

Both black and brown rusts appeared late in the season, brown rust being more predominent. The infection was not severe expect in isolated fields under irrigation. The loss caused by both these rusts was negligible or very light.

Hyderabad (S. Vaheeduddin)[7]

The black rust of wheat was observed on 14-2-1954, when the crop was in the post-flowering stage and was of mild intensity. It caused a reduction in yield of about 4-5%. The principal wheat varieties under cultivation in the State were PW, PW-5, PW-12, Niphad 81 and Pusa 4. There was practically no rain preceding the outbreak of rust, but there was dew fall during December and January.

Mysore (N. S. Venkatakrishniah)[8]

The black and brown rusts of wheat were observed in moderate intensity at the tillering and 'boot' stages. The black rust was more virulent and a reduction in yield of 2-5% was estimated. There was light rainfall and moderate dew, a month or two before the outbreak of rusts.

Andhra (P. Govinda Rao)[9]

The black and brown rusts were observed in a mild form and caused negligible damage. Brown rust appeared when the crop was in the flowering stage. There was practically no rainfall preceding the outbreak of rusts, although there was moderate dew.

Madras*

During the year all the three rusts were observed in the State.

In the Coimbatore Circle, brown and black rusts were observed. The brown rust appeared earlier from the time the crop was in the 'boot' stage and was severe in intensity. There was relatively less rainfall a month or two preceding the outbreak of rusts. The average monthly temperatures during the period ranged from 50° F. to 75° F. *Samba* wheat was the principal wheat variety under cultivation.

In the Nilgiris, all the three rusts were observed on the wheat crop. Black rust was noticed in traces and brown and yellow rusts occurred in mild form. Brown rust was the earliest to appear when the crop was in the tillering and 'boot' stages. However, none of the rusts appeared in virulent form and there was practically no loss in yield. There was moderate rainfall during the season and the temperatures ranged from 40° F. to 73° F. There were about 500 acres of *kharif* wheat in the district. Except for an Australian wheat 'Gebo' grown for its field resistance to rusts, local *samba* was the chief variety under cultivation. This was susceptible to brown and yellow rusts, whereas the Australian variety 'Gebo' had only traces of these rusts.

In the Madurai Circle, only yellow rust was observed in moderate intensity The rainfall during the season was moderate to heavy and the temperature ranged from 54° F. to 62° F. '*Samba*' wheat was the principal variety under cultivation.

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6. Plant Pathologist, Government of Bombay, College of Agriculture, Poona.
7. Plant Pathologist, Main Agricultural Farm, Himayatsagar, Hyderabad.
8. Plant Pathologist, Department of Agriculture, Bengalore, Mysore.
9. Agricultural Mycologist, College of Agriculture, Bapatla, Andhra.

* Report received from the Director of Agriculture.

SHORT NOTES

(i) An unusually severe incidence of leaf smut of paddy at Karnal, Pnnjab

Leaf smut of paddy (*Entyloma oryzæ* H. and P. Sydow) has been reported from India, Burma, Afghanistan, Japan, Formosa, U.S.A., Philippines, Argentina, Venezuela and probably China. In India, it has been reported from the States of Bombay, Orissa, Bihar and Uttar Pradesh. The disease was observed in an epidemic form at the Cattle-cum-Dairy Farm. Karnal, Punjab, during September -October, 1953. About 300 acres of paddy consisting of the varieties N.P. 130, U.P. Type 21 and the Punjab 'Jhona', were sown at this farm. The seeds were obtained from the Indian Agricultural Research Institute, New Delhi, Lakhimpur-Kheri (Uttar Pradesh) or locally from Karnal. The seedlings were transplanted between June 20 and August 16. The variety N.P. 130 was transplanted between June 20 and July 11 and was followed by the U.P. variety transplanted between July 12 and August 13. The Punjab 'Jhona' was transplanted last, between August 13 and 16.

There were fairly intermittent showers from the middle of June to the end of September and the maximum temperature did not go beyond 100°F. after the first transplantations.

Except for the Punjab 'Jhona', the bulk of paddy was sown in one compact block which had been under paddy cultivation last year as well. The disease appeared early in September and gradually assumed severity. By the middle of October it was widely prevalent. Infections on the variety N.P. 130, which was sown early, were heavy. Over 65% of the leaf area of most of the the leaves was covered with lead-black smut sori. The sori were invariably restricted to the leaf laminae, rarely on the leaf-sheath and in no case was any sorus observed on any part of the panicle. The U.P. Type 21 which was sown later developed only a mild infection. The 'Jhona' variety, which was the last to be transplanted was completely free from infection till about the end of October, when final observations were made.

P. R. Mehta
A. P. Misra

Directorate of Plant Protection,
Quarantine and Storage.
NEW DELHI

(ii) A new disease of *Trapa bispinosa* Roxb

Trapa bispinosa Roxb. is a valuable crop in Delhi, Uttar Pradesh and the adjoining States. It is an aquatic plant with floating, broad, succulent leaves and bears edible nuts, which are very rich in starch contents. It is principally a monsoon crop and is raised between July and October. So far no disease has been recorded on this plant. During the course of plant disease surveys in Delhi State, a new disease, causing a severe leaf rot was observed between September and October, 1950, in some ponds at Najafgarh in Delhi State. Since then it has been regularly observed about the same time during the following years.

The disease is characterised by pronounced rotting of the leaves (petioles as well as laminae of the leaves) and the development of a dense white cottony mycelium, mostly on the under surface of the lamina and around the petioles. Sclerotia are developed in abundance and are studded over the mycelium as tiny brown mustard seed-like bodies.

The mycelium is septate, fragile, 3-5 microns in diameter, the sclerotia are roundish or oval, 0.7 to 1.1 mm. long and 0.6 to 0.9 mm. broad. The fungus has been identified as *Sclerotium rolfsii* Sacc.

A.P. Misra

Directorate of Plant Protection,
Quarantine and Storage,
NEW DELHI.

(iii) On Spongospora subterranea (Wallr.) Lagerheim on Solanum tuberosum L.

In March, 1954, 7,000 lbs. of seed potato, var. L Great Scot, were imported by Messrs Parry and Co., Ltd., Madras, from Scotland, for cultivation in the Nilgiris (South India). The consignment was accompanied by the necessary phytosanitary certificate. However, an inspection undertaken at the Quarantine (Fumigation) Station, Madras, revealed an infection of powdery scab (*Spongospora subterranea* (Wallr.) Lagerh) on about 2% of the tubers. A few to as many as 30-40, circular, usually ruptured blisters of varying sizes, upto 4-5 mm. across, were present on the affected tubers. The spore balls were mostly sub-epidermal, extending to about $\frac{1}{4}$ mm. depth in the parenchymatous tissues, brownish, irregularly globose, ovate or cylindric, $52 \times 41 \mu$ (range 14×11 to $144 \times 112 \mu$, usually $29\text{-}76 \times 18\text{-}72 \mu$) while the individual spores measured $3\text{-}4 \mu$. Quite a large number of scabby tubers were also affected by rots associated with species of *Alternaria*, *Fusarium* and *Cephalothecium*.

The diseased tubers were hand-picked and destroyed and the rest disinfected by dipping in a 1 : 1000 mercuric chloride solution in water, for 10—20 minutes before release, to eliminate any chance of introducing any new race of the fungus in the country. The disease, though recorded from the Nilgiris is not yet known to be serious, nor does it appear to be very common.

S. N. S. Srivastava.
P. Krishna Menon.

Plant Quarantine & Fumigation Station,
(Directorate of Plant Protection,
Quarantine & Storage),
MADRAS.

NOTES AND NEWS

(i) Record of Khapra beetle in U. S. A.*

The Khapra beetle (*Trogoderma granarium* Everts.), an insect unknown in America until last November, has been found infesting grain warehouses in 12 counties of California, Arizona and New Mexico in U.S.A. It was first discovered in Tulare County, California. Immediately co-operating entomologists of the U. S. Department of Agriculture and 11 western states surveyed grain storages in these states to determine the extent of the infestation in U. S. A. More intensive inspection of warehouses is now in progress in the states already found infested, and will be extended to other states into which the insect might have reached through grain shipments. Co-operative federal-state control and regulatory measures to keep the pest within its present bounds are being considered. A new USDA field station for research on stored grain insects, particularly the Khapra beetle, has been set up at Mesa, Arizona. First work of the new station will be directed at the development of fumigation procedures or other treatments to kill the Khapra beetle in grains and the investigation of fumigants and sprays for application to infested structures and surrounding areas to reduce or eliminate existing infestations.

(ii) Electronic Detective for discovering Termita@ infestation in wood

A small portable electronic listening device that might serve as an aid in the detection of many wood-boring insects like termites has been developed by the University of California, Los Angeles and is being field tested further. The unit consists primarily of a small, light weight instrument which, in essence, is a high-gain, low-noise, frequency selective amplifier. A highly sensitive pick-up with a slender, needle-like probe protruding from the head is attached to a lead which plugs into the body of the amplifier. The probe may be pushed into any hardwood surface and leaves only the smallest of holes when removed. A light pair of earphones completes the instrument, which has a gross weight of about three pounds. A small, thumb-controlled, on-off volume control is situated near the handle, enabling the switching of the "on and off" and "gain control" to be accomplished with one hand. The current model includes a small meter which indicates power drain on the "A" battery.

(iii) A Mystery of Dieldrin Resistance**

While carrying out trials of the insecticidal value of dieldrin, K. F. Goodwin-Bailey and M. Davies of Cooper Technical Bureau (Borkhamsted, Herts, made a discovery that is as puzzling as it is disturbing. A high degree of resistance to dieldrin was found in a strain of houseflies never before exposed to this insecticide, although the development of resistance to D.D.T. and B.H.C. had been suspected. The flies were bred to the third and fourth generation from a strain collected from a refuse tip that had been sprayed for four years with D.D.T. and B.H.C. Compared with susceptible controls, the flies were 19 times more resistant to D.D.T., 53 times more resistant to gamma-BHC and

*Extract from 'Pest Control', Volume 22, No. 11, p. 9, 1954.
@Extract from 'Pest Control', Volume 22, No, 11, p. 27 & 30, 1954.
**Extract from Science News Letter No. 148, issued by the Scientific Adviser, India House, London.

no less than 266 times more to dieldrin. No increase in resistance to pyrethrins was observed, however. While exposure to one insecticide frequently selects strains of insects that show resistance to several insecticides of related chemical structure, it is difficult in this case to account for the magnitude of the resistance to dieldrin (Nature—30th January, 1954).

(iv) Less Myxomatosis in Australia-No trace on plains@

Officers of the Commonwealth Scientific Research Industrial Organization say that myxomatosis, which destroyed three-quarters of the rabbits in eastern Australia after its introduction in 1950, is not spreading rapidly this summer. It is evident only along the river beds. On the vast plains in between, where this time last year rabbits were dying in thousands, there is no sign of the disease.

Blood tests showed that almost all survivors had recovered from myxomatosis, whereas normally less than one-half of 1 per cent of infected rabbits lived. There was no evidence yet of rabbits acquiring immunity and transmitting this to their progeny, though that is expected to happen eventually. The popular theory is that myxomatosis, not the rabbit, has changed through mutations which cause the disease to wax and wane. Between 1950 and 1952 the disease spread because the rainfall was well above the average ; this provided ample water for breeding mosquitoes, which bit the rabbit and spread the disease. (The Times-19th January, 1954).

(v) Tortoise, a new pest of Singhara crop in North India**

The tortoise is reported for the first time to damage young *singhara* (*Trapa bispinosa*) plants in Meerut district of Uttar Pradesh. The animal feeds on the young fruits only when they are soft and without thorns. The damage is usually caused in the early part of October when the crop is young. The extent of damage caused is not definitely known, but is estimated to vary from 5% to 25%. The cultivators have attempted to dissuade this pest from young *singhara* fruits by feeding them with parched maize and *jowar* grains.

It is likely that tortoise may prove a potential pest in future and cause severe damage to the *singhara* fruits, which are a source of livlihood to many farmers.

@Extract from Science News letter No. 142, issued by the Scientific Adviser. India House, London.

**Compiled in the Directorate of Plant Protection, Quarantine & Storage